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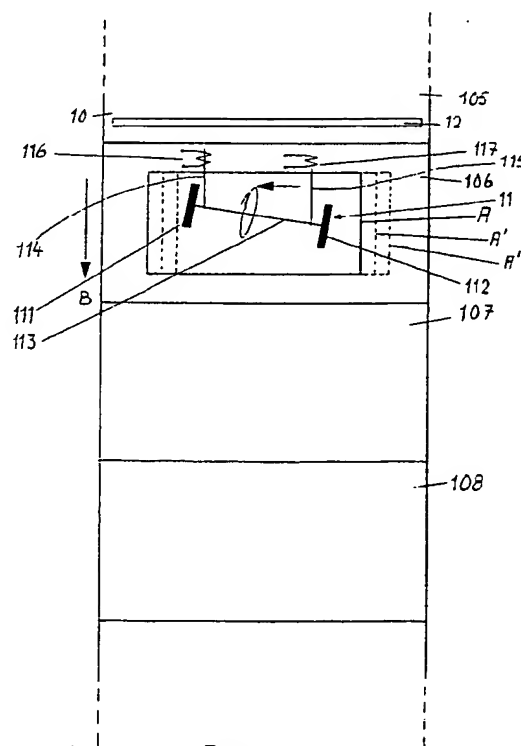
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(54) **An arrangement for correctly feeding thin objects, such as banknotes, cheques, etc.**

(57) An arrangement for feeding flat, thin objects, such as valuable documents in the form of banknotes, cheques, etc., along a transport path (10), comprises object straightening and repositioning means which straighten or reposition the objects as they pass sequentially along the transport path. The straightening means includes rotating driven object straightening rollers (111, 112) which lie briefly against the objects as the objects pass along the transport path (10). According to the invention the straightening means comprises two rotatable, driven straightening rollers (111, 112) each being mounted on a driving shaft (113; 51, 52) and intended to lie in abutment with said objects. The straightening means further includes control means (114-117; 51-54) which causes the rollers (111, 112) to move in accordance with the deviation of respective objects from an intended correct position on the transport path.

**Fig 1**

Description**TECHNICAL FIELD**

The present invention relates to an arrangement for feeding flat, thin objects, such as valuable documents in the form of banknotes, cheques, etc., along a transport path, comprising object straightening means which straighten the objects as they pass sequentially along the transport path, said straightening means including rotating object-straightening rollers which lie briefly against the objects as the objects pass along the transport path.

BACKGROUND ART

It is known to straighten, for instance, banknotes as they pass from an infeed opening to a storage space.

For instance, Swedish Patent 8503668-9 and U.S. Patent 4757903 teach a straightening means which comprises a cylindrical drum and a straightening wheel in abutment therewith, the periphery of which is slotted to provide a plurality of fingers which are rigid or stiff in the peripheral direction and relatively slack in the radial direction.

Although such straightening means are effective when transporting banknotes in one and the same direction, they have been found less effective when used in the transportation of banknotes in two directions at high speeds.

The object of the present invention is to eliminate this drawback.

DISCLOSURE OF THE INVENTION

This object is achieved with an inventive object-straightening means comprising two rotatable and driven straightening rollers, each of which is mounted on a driving shaft and intended to lie in abutment with said objects, and further comprising control means which cause the rollers to move in accordance with the deviation of respective objects from an intended correct or ideal position on the transport path.

These and other characteristic features of an inventive arrangement will be apparent from the following Claims.

BRIEF DESCRIPTION OF THE DRAWINGS

The invention will now be described in more detail with reference to the accompanying schematic drawings, in which

Fig. 1 illustrates straightening means for correcting the lateral positions of objects on the transport path;

Fig. 2 illustrates straightening means for correcting

the positions of objects by rotating the same in a horizontal plane;

Fig. 3 illustrates a straightening means for correcting the positions of objects in a rearward sense;

Fig. 4 illustrates straightening means for correcting the positions of objects in a forward sense;

Fig. 5 illustrates a modified embodiment of the straightening means; and

Fig. 6 is a block schematic illustrating an inventive arrangement.

DESCRIPTION OF PREFERRED EMBODIMENTS

Fig. 1 illustrates a transport belt 10 which is conceived as moving temporarily from above and downwards, see the arrow on the left of the Figure. The belt is divided into a number of segments 105, 106, 107, 108..., each of which is intended to receive an object, in this case a banknote. A banknote placed in segment 106 is shown in its intended correct position A in full lines. Two positions A' and A" in which the banknote is displaced slightly laterally to the right are shown in dotted lines. It is conceivable that banknotes are to be transported between two storage reels in both directions, so as to enable the infeed and outfeed of banknotes of different denominations. It is therefore desirable to be able to keep an account of which type of banknotes are present in respective segments, and it is therefore important that the banknotes are positioned correctly so that intended banknotes can be located on the coded belt despite the possibility of the banknotes being conveyed backwards and forwards several times. The belt together with transport rollers (not shown) forms a transport path between the two storage reels. Each of the different segments is allocated an individual code so that when a banknote is detected in a particular segment, for instance a Swedish banknote valued at SEK 500, information relating to the segment in which this banknote is located will be stored in a memory provided to this end. This enables a check to be kept on the number of banknotes that have been fed into the belt and in which segments banknotes of desired kinds and desired denominations can later be found. A more detailed description of coded belts and associated control and storage means is found in Swedish Patent Application 9501180-5 which is included in this document by virtue of this reference.

The arrangement includes bank-note straightening and repositioning means 11 which function to straighten and correctly position any banknote that may be askew or have moved out of position. The illustrated straightening means 11 include two rubber rollers 111 and 112 mounted on a common shaft 113 which can be displaced

in the direction of the belt 10 and also turned through some degrees in a clockwise or anticlockwise direction, depending on whether the banknote shall be moved backwards or forwards or whether it shall be straightened. The shaft 113 is twisted horizontally with the aid of two relay-actuated control rods 114, 115, each of which actuates its own relay 116 and 117 respectively.

Arranged transversely across the whole of the width of the belt 10 is a row of sensors 12 which together produce an output signal which indicates that a banknote is incorrectly positioned and also the direction in which the banknote shall be manipulated in order to be positioned correctly. This signal actuates the relays 116, 117, either one at a time or both at once depending on how the banknote shall be manipulated in order to bring it to its correct position.

If the sensors 12 detect that the banknote is located too far to the right, e.g. in position A', as the banknote is transported downwards in the direction of arrow B, the relay 116 is actuated before the banknote reaches the straightening means 11. When the banknote arrives at the straightening means, it will be subjected to a force component which moves the banknote downwards (with the belt 10) and also by a force component which moves the banknote to the left on the belt (at right angles to the belt 10), therewith moving the banknote both forwardly (downwards in the direction of the arrow B) and some millimeters to the left as the banknote is transported through the rollers 111, 112 of the straightening means. It will be understood that the rollers 111, 112 have the same peripheral speed as the transport belt 10.

The relay 116 switches off as the banknote leaves the rollers 111, 112, therewith bringing the straightening means 11 into readiness for straightening or repositioning following banknotes.

Should the banknote be positioned too far to the left, the relay 117 is actuated so as to adjust the banknote in the opposite direction to that aforescribed, i.e. to the right.

Fig. 2 illustrates the case when a banknote approaching the row of sensors 12 is skewed slightly in a horizontal direction, with the right short-side of the banknote being before the left short-side of the banknote as shown in the drawing in broken lines. The relay 116 (Fig. 1) is then actuated before the banknote reaches the straightening means 11 and switches off when the banknote is half way beneath the rollers 111, 112. This deactivation of the relay causes the left side of the banknote to be driven forwards by some further millimeters than the right short-side of the banknote.

More specifically, the shaft 113 carrying the rubber rollers is positioned obliquely as a result of the actuation of the relay 116, prior to the banknote reaching the rollers. When the banknote is located beneath the shaft 113, the relay 116 is deactivated and the shaft will return to its normal position while entraining the banknote. The banknote is thus acted upon by two forces, i.e. by the "normal" driving force exerted by the belt 10 and the

twisting force exerted by the roller 111 on the shaft 113 as the shaft moves.

Naturally, when the left short-side arrives at the sensors before the right short-side, the banknote will be straightened in the same way as that described above, but with the aid of the relay 117.

Fig. 3 illustrates the case when a banknote on the belt 10 arrives somewhat prematurely at the sensors, as shown in broken lines. In this case, both relays 116, 117 are actuated simultaneously when the banknote is located halfway beneath the rollers of the straightening means 11. This causes the banknote to be moved some millimeters horizontally and rearwardly on the belt. The relays are deactivated when the banknote has left the rollers 111, 112.

Fig. 4 shows the case when a banknote arrives on the belt 10 somewhat late, as shown in broken lines and arrives at the sensors 12 somewhat belatedly. In this case, both relays 116, 117 are activated before the banknote reaches the rollers of the straightening means, therewith causing the shaft and the rollers to be withdrawn rearwardly. When the banknote is located beneath the rollers, the relays are deactivated therewith causing the rollers and the shaft to return to their normal position while entraining the banknote forwards some few millimeters in the movement direction of the belt 10.

According to the aforescribed embodiment, the control means functions to impart a translatory movement and a turning or twisting movement to the straightening means. However, this control can be effected in other ways within the scope of the inventive concept as defined in the following Claim 1.

One method of enhancing lateral displacement of a banknote, or other document, is to effect lateral movement of the shaft 113, e.g. magnetically.

Another method is to change the peripheral speed of individual rollers 111, 112 of the straightening means with the aid of stepping motors. One such straightening means is illustrated in Fig. 5. Fig. 5 shows a banknote in three different positions. In position 1, the banknote is shown at the moment of passing a sensor means 12 which detects the position of the banknote on the belt 10. In position 2, the banknote has been transported to a position beneath straightening means 51-54 at a speed v_0 . The straightening means 51-54 includes shafts 51, 52, one for each roller 111, 112, and stepping motors 53, 54, one for each shaft. These motors are activated individually in accordance with the deviation of the banknote from its intended, correct position on the belt 10. In the illustrated case, the motor 53 has been activated momentarily, so that the shaft 51 and the wheel 111 will rotate at a higher speed corresponding to Δv_0 , thereby turning the banknote into its correct position, referenced 3 in the Figure.

Fig. 6 is a block schematic showing the sensor means 12, which includes a row of sensors across the full width of the belt 10; a control unit 50 which is programmed to control the relays 116, 117 or the stepping

motors 53, 54, so as to deliver to the rollers 111, 112 impulses that are adapted to turn/displace a crooked banknote into its correct position.

Claims

1. An arrangement for feeding flat, thin objects, such as valuable documents in the form of banknotes, cheques, etc., along a transport path, comprising object straightening means which straighten the objects as they pass sequentially along the transport path, said straightening means including rotating object straightening and repositioning rollers which lie briefly against the objects as the objects pass along the transport path, **characterized** in that the straightening means comprises two rotatable, driven straightening rollers (111, 112), each of which is mounted on a driving shaft (113; 51, 52) and intended to lie in abutment with said objects; and in that said means further comprises control means (114-117; 51-54) which causes the rollers (111, 112) to move in accordance with the deviation of respective objects from an intended correct position on the transport path.
2. An arrangement according to Claim 1, **characterized** in that the two rollers (111, 112) have a common rotatable shaft (113) which normally extends perpendicular to the direction of movement of the transport path; and in that the control means (114-117) functions to impart to the shaft (113) and the rollers (111, 112) a short translatory movement and a relatively slight twisting movement parallel with the transport path, in accordance with the deviation of respective objects from their intended correct positions on the transport path.
3. An arrangement according to Claim 2, **characterized** in that the control means includes two relay means (116, 117) which act on the shaft (113) close to the ends thereof, wherein both relay means (116, 117) are activated to effect said translatory movement, while only one relay means, (e.g. 116), is activated to effect said twisting movement, depending on the direction in which the banknote is to be twisted or turned in order to be positioned correctly.
4. An arrangement according to Claim 1, **characterized** in that the two rollers (111, 112) are each mounted on an individual shaft (51, 52), said shafts extending permanently at right angles to the direction of the transport path; and in that the control means (51-54) function to impart rotary movement to the shafts (51, 52), and therewith the rollers (111, 112) in dependence on the deviation of respective objects from an intended correct position on the transport path.
5. An arrangement according to Claim 4, **characterized** in that the control means includes two stepping motors (53, 54), one for each shaft (51, 52), wherein the stepping motors are activated individually in accordance with the deviation of respective objects from an intended correct position on the transport path.



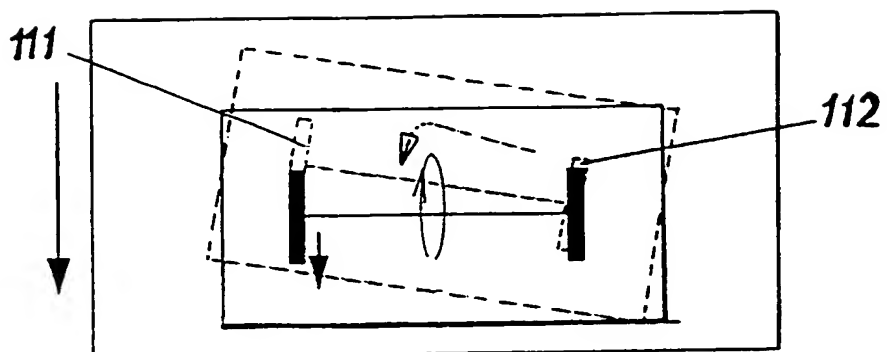


Fig 2

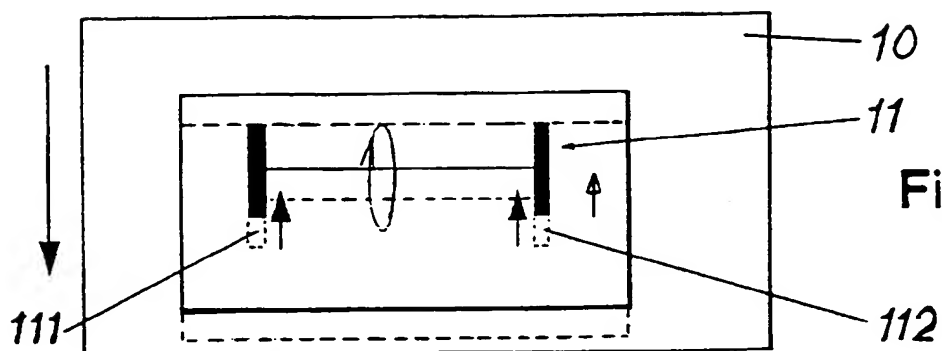


Fig 3

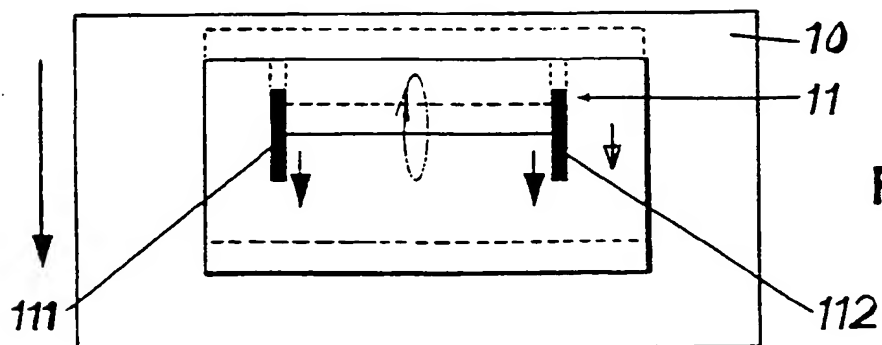


Fig 4

Fig 5

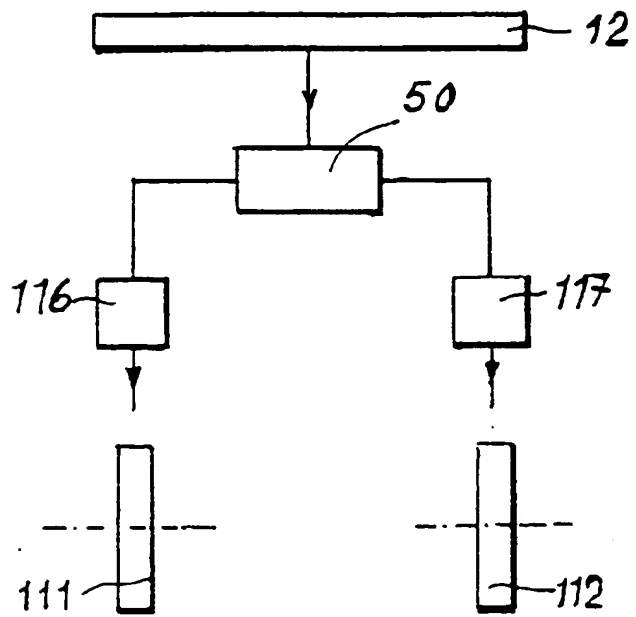
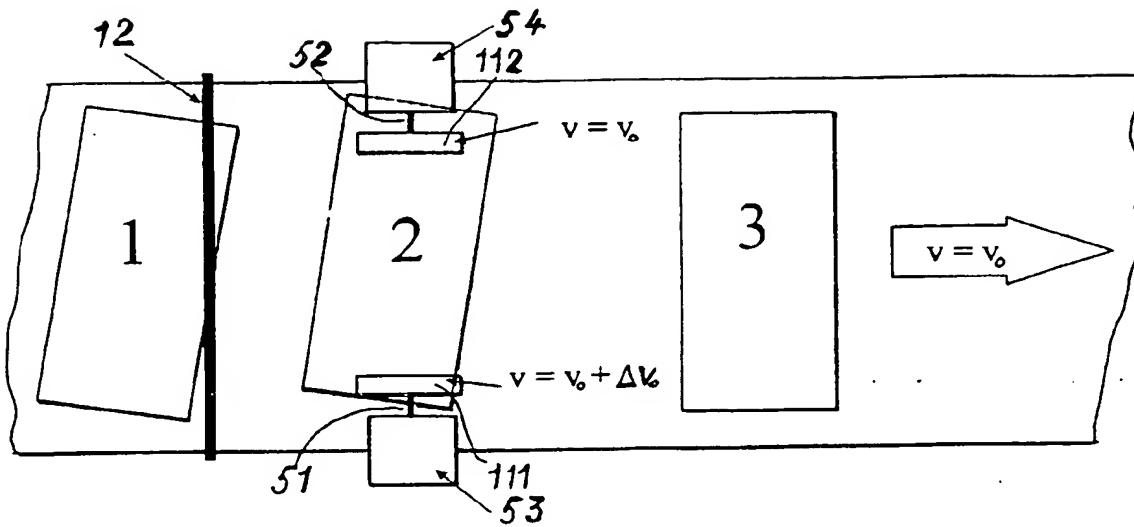


Fig 6

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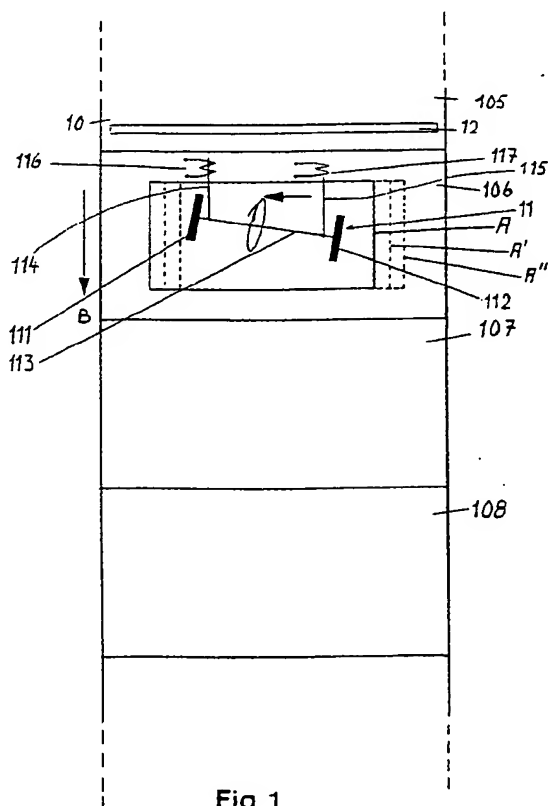


Fig 1

EP 0 736 473 A3



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EUROPEAN SEARCH REPORT

Application Number
EP 96 85 0050

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.6)
X A	EP-A-0 541 260 (XEROX CORP) 12 May 1993 * the whole document *	1,4,5 2,3	B65H9/10
X A	EP-A-0 485 167 (XEROX CORP) 13 May 1992 * the whole document *	1,4,5 2,3	
A	EP-A-0 473 884 (HEWLETT PACKARD CO) 11 March 1992 * the whole document *	2,3	
A	EP-A-0 536 885 (MOORE BUSINESS FORMS INC) 14 April 1993 * the whole document *	1-5	
The present search report has been drawn up for all claims			TECHNICAL FIELDS SEARCHED (Int.Cl.6)
			B65H
Place of search		Date of completion of the search	Examiner
THE HAGUE		9 August 1996	Madsen, P
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